

EFFECT OF FROZEN STORAGE ON THE QUALITY OF JAMUN FRUITS

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(Received August 16, 1990; revised June 20, 1991)

The effect of frozen storage on the quality of edible portion of different jamun varieties was studied. During storage, acidity, ash, total soluble solids and reducing sugar contents increased while moisture, ascorbic acid, pH and non-reducing sugars decreased in both varieties of jamun. Though scores for colour, flavour, taste, and texture decreased while those of sweetness increased upto 300 days of frozen storage, the frozen product remained in good quality as regards its acceptability.

Key words: Frozen storage, Raa and desi fruit, Organoleptic evaluation.

Introduction

Jamun (*Eugenia jambolana* L.) is an important fruit of Indo-Pak sub-continent [1]. Generally two main varieties of jamun are distinguished based on the type of fruit. The raa jamun fruits have sweet flesh with central cavity containing small seeds. While 'desi' jamun fruits have relatively large seeds and acidic flesh. In Pakistan these fruits are grown on 1277 hectares with total annual production of 5772 tonnes out of which 5528 tonnes is for Punjab and 224 tonnes for Sindh [2].

Jamun fruit is known to have some medicinal value as it is considered to improve digestibility and helps to prevent diabetes [3]. Fresh fruit is consumed in the season, but can also be preserved in the form of syrup, nectar, squash, spicy ready-to-serve beverage, preserve and fruit bars. [4-6]. Cull and unripe fruits are used to make fruit vinegar [7]. The attractive purplish colour in jamun beverage is due to presence of anthocyanin pigments [8]. The refrigerated storage in general had stabilizing effect on the anthocyanins in the fruit juices [9] and nectar [10].

The fresh jamun fruit have very poor keeping quality. The objective of this work was to see the possibilities of extending the utility of jamun fruit by frozen storage.

Materials and Methods

Preparation and storage of fruits. The 'raa' as well as 'desi' jamun fruits were procured from local market and University Campus, Faisalabad. The berries were washed and the unripe and over-ripe fruits were removed. The flesh was separated by hand, packed (25 gm/pack) in opaque plastic bags, sealed and stored in deep freezer at -18°.

Evaluation. The edible content was determined by separating the seeds from the fruit manually. The frozen flesh was analysed at specific storage intervals for acidity, pH, ash, moisture and total soluble solids using standard methods [11]. Similarly ascorbic acid was determined by a colorimetric

method [12] and sugars were estimated by the Lane and Eynon method [13]. Organoleptic evaluation was done by a panel of 8 judges using scoring method [14]. The effects of varieties and storage on quality of jamun were compared using student's 'T' test [15].

Results and Discussion

The edible portions in the form of fruit flesh were 58.50±3% in 'desi' and 68.03 ± 5% in 'raa' jamun fruits (Table 1). The contents of stones derived from these figures come to about 41.50 and 31.97% for 'desi' and 'raa' varieties of jamun fruits respectively. On the basis of these observations, it is noted that the edible contents were comparatively higher in 'raa' fruits than those of 'desi' variety of jamun fruits. These results are in agreement with the previous findings [5] in which 'raa' jamun fruits were reported to contain more edible contents and smaller seeds as compared to 'desi' fruits having bigger seeds and less edible portion.

TABLE 1. EDIBLE CONTENTS IN TWO VARIETIES OF JUMUN FRUITS.

Variety	Fruit weight (g)	Flesh weight (g)	Stone weight (g)	Flesh yield (g)
Desi	567.3±30	354.0±18	213.3±11	58.50±3
Raa	451.0±24	296.0±13	155.0±9	68.03±5

Results are expressed as mean ± SD of 6 observations.

Fresh 'raa' jamun had comparatively high moisture, total soluble solids and reducing sugar contents than those of 'desi' fruit. (Table 2). However 'desi' jamun fruits had higher acidity, ash, ascorbic acid and non-reducing sugar contents. When the fruits were evaluated for organoleptic characteristics (Table 3) on the basis of overall rating both 'raa' and 'desi' varieties were found to be equal.

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Acidity and pH. Acid contents were 0.70 and 0.96 % for 'raa'; and 0.75 and 1.08% for 'desi' variety at harvest and after 120 days of storage, respectively (Table 2). The acid content

TABLE 2. EFFECT OF FROZEN STORAGE ON SOME CHEMICAL CONSTITUENTS OF TWO JAMUN VARIETIES.

Variety	Storage (days)	TSS (%)	Moisture (%)	Acidity (%)	pH	Ash (%)	Ascorbic acid (mg/100g)	Sugars	
								Reducing	Non-reducing
Raa	0	9.57	90.42	0.70	3.6	1.01	11.97	8.33	1.18
	30	10.43	86.41	0.84	3.6	1.01	9.53	9.37	1.42
	60	10.60	85.11	0.90	3.6	1.07	9.00	9.75	0.96
	90	10.91	85.02	0.94	3.5	1.08	8.50	10.14	0.93
	120	11.53	85.03	0.96	3.5	1.12	8.00	10.19	0.92
	Means	10.61	86.4	0.97	3.5	1.06	9.4	9.50	1.08
Desi	0	9.18	89.64	0.75	3.5	1.08	14.77	7.90	1.43
	30	10.33	85.50	0.89	3.4	1.07	12.00	9.27	1.12
	60	10.41	85.00	0.95	3.4	1.05	11.50	9.31	1.26
	90	10.80	84.44	1.01	3.3	1.10	10.50	9.51	1.30
	120	11.00	84.49	1.08	3.3	1.30	10.00	9.77	1.08
	Means	10.30	85.08	0.94	3.3	1.12	4.75	9.15	1.24
LSD @ 0.01:									
Variety		NS	.40	.05	.05	.06 (P=0.05)	.06	.05	NS
Storage		.30	.63	.16	.08	.13	.09	.07	NS

Results are expressed as mean values for 3 observations.

TABLE 3. EFFECT OF FROZEN STORAGE ON THE SENSORY CHARACTERISTICS OF TWO VARIETIES OF JAMUN FRUITS.

Variety	Storage	Out of a maximum score of 10 for standard of excellence					Sweetness	Overall rating out of 50 scores
		Colour	Flavour	Taste	Texture	Texture		
Raa	0	8.50	8.37	8.50	8.33	7.50	41.20	
	120	6.68	7.31	7.00	7.00	7.90	35.99	
	300	6.57	7.25	6.77	7.00	8.03	35.62	
	Means	7.25	7.64	7.42	7.44	7.81		
Desi	0	8.55	8.43	8.17	8.20	7.30	40.65	
	120	7.00	7.29	6.79	7.15	7.47	35.70	
	300	6.88	7.18	6.00	7.00	7.80	34.86	
	Means	7.47	7.63	6.99	7.45	7.52		
LSD @ 0.01								
Variety		NS	NS	.22	NS	NS		
Storage		.37	.08	.27	.43	NS		

Results are expressed as mean values for 8 judges.

in both the varieties increased ($p=0.01$) with reciprocal changes ($p=0.01$) in pH during frozen storage period of 120 days. Increased acid content may result from the conversion of pectin to pectic acid. This is in contrast to earlier work [16] in which a decline in acid contents of fresh jamun was noticed during storage at room temperature.

Ascorbic acid. Ascorbic acid contents decreased from 11.97 mg/100gm to 8.0 mg/100gm in 'raa' and from 14.77 mg/100gm to 10 mg/100gm in 'desi' jamun during frozen storage after 120 days with significant ($p=0.01$) effect both for varieties and storage (Table 2). The trend in results during storage agreed with previous findings in fresh jamun. A similar decrease in ascorbic acid was also noticed in fresh rownberries stored at 2 to 3° for 3 months [10].

Ash. Ash contents were 1.01 and 1.12% for 'raa' and 1.08 and 1.2% for desi variety at 0 and 120 days of storage respec-

tively. The ash contents in 'raa' and 'desi jamun increased at significant ($p=0.01$), level during frozen storage (Table 2). This increase in ash might be due to loss in moisture contents during storage.

Moisture. The moisture level in jamun flesh decreased ($p=0.01$) significantly during frozen storage of 4 months. The actual moisture contents decreased from 90, 42 to 85.03% in 'raa' and from 89.64 to 84.49% in 'desi' jamun (Table 2). A similar decreasing trend was also observed in fresh jamun during storage at room temperature [16]. This loss may be due to evaporation of moisture from fruit during such storage.

Sugars. Reducing sugars increased from 8.33 to 10.19% in 'raa' and from 7.90 to 9.77% in 'desi' fruits. While non-reducing sugars decreased from 1.18 to 0.92% in 'raa' and from 1.43 to 1.08% in 'desi' (Table 2). A significant ($p=0.01$) increase in reducing sugars with a reciprocal decrease ($p=0.01$)

in non-reducing sugar were noticed in jamun fresh during 4 months of frozen storage.

Total soluble solids. Total soluble solids increased from 9.57 to 11.53 in 'raa' and from 9.18 to 11.0 in 'desi' jamun after a frozen storage period of 120 days. Total soluble solids in fresh jamun fruits increased at a significant ($p=0.01$) level during frozen storage. These results agreed with previous findings in jamun [16] and may be due to conversion of nonreducing sugars to reducing sugars during storage.

Colour and flavour. The scores for colour and flavour in jamun fruit decreased abruptly ($p=0.01$) during first 120 days of frozen storage (Table 3) and thereafter a slight decrease occurred up to 300 days storage. At the end of the storage period score for colour decreased ($p=0.01$) from 8.50 to 6.57 in 'raa' and from 8.55 to 6.88 in 'desi' fruits while scores for flavour decreased ($p=0.01$) from 8.37 to 7.25 in 'raa' and from 8.43 to 7.18 in 'desi' fruits.

Taste and sweetness. The scores for taste decreased ($p=0.01$) from 8.50 to 6.77 in 'raa' and from 8.17 to 6.0 in 'desi' jamun. Whereas scores for sweetness increased from 7.50 to 8.03 in 'raa' and from 7.30 to 7.80 in 'desi' fruits.

Texture. The scores for texture decreased ($p=0.01$) from 8.33 to 7.0 in 'raa' and from 8.20 to 7.0 in 'desi' jamun during storage at -180° for 300 days. The maximum decrease in scores was observed during 120 days storage.

The fresh 'desi' variety was superior to raa' in respect of colour, flavour, ascorbic acid, acidity and ash contents while 'raa' variety was better than 'desi' in respect of taste, sweetness and total soluble solids. Furthermore, jamun flesh can be stored successfully for more than 10 months at 180° without losing its acceptability.

Acknowledgement. The authors wish to thank Dr. Amjad Ali, Chairman, Food Technology Department, for providing facilities during these research studies.

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